

FINAL SUBMITTAL EXECUTIVE SUMMARY

FORT PICKETT

ENERGY ENGINEERING ANALYSIS PROGRAM

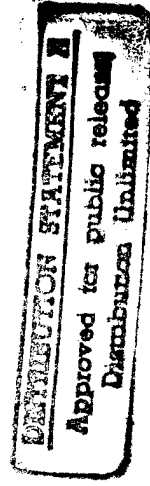
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for the NORFOLK DISTRICT
CORPS OF ENGINEERS

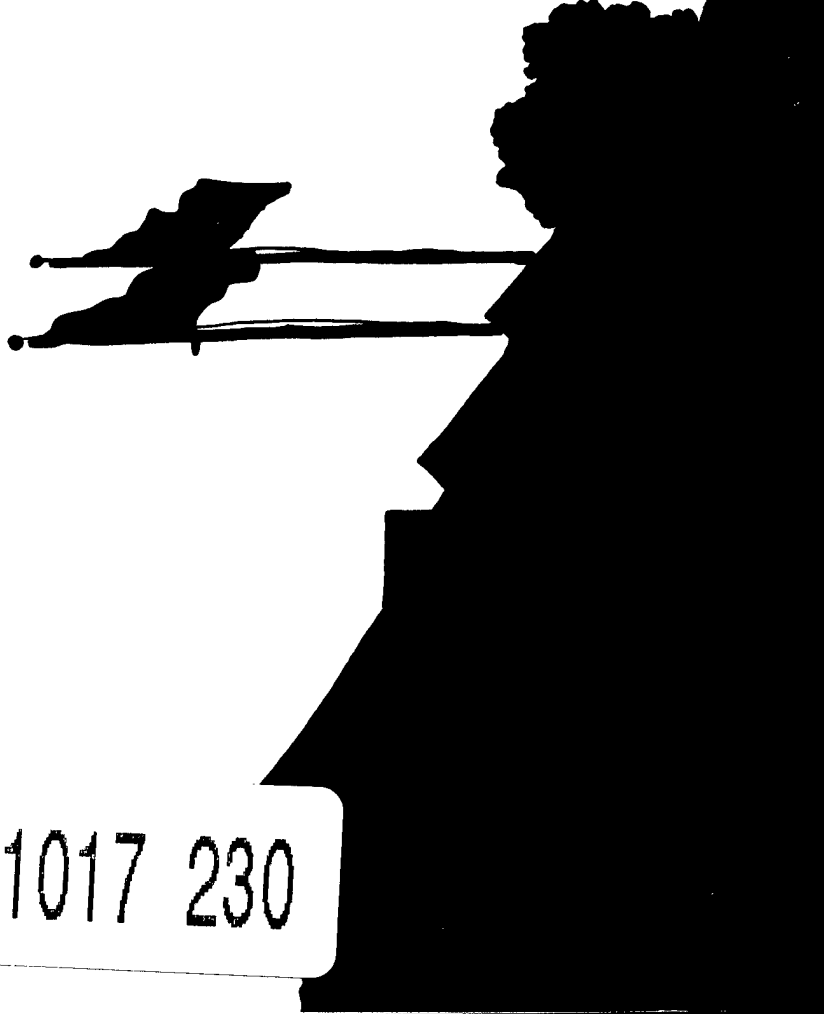
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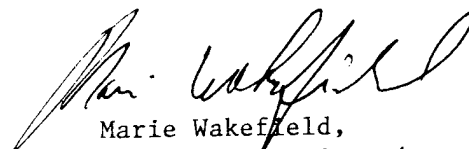


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FORT PICKETT

ENERGY ENGINEERING ANALYSIS PROGRAM

CONTRACT NO DACA65-81-C-0021

FOR THE

NORFOLK DISTRICT CORPS OF ENGINEERS

PREPARED BY

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IV EXECUTIVE SUMMARY

1. INTRODUCTION

1.1 OBJECTIVE

This is a summary of an Energy Engineering Analysis, conducted to provide a Basewide Energy Savings Plan at Fort Pickett, Virginia. This Plan includes recommendations for energy conservations Projects to reduce the installation's present energy consumption, as well as a description of other energy-related factors which affect consumption. It is important to note that savings figures presented in this summary can only be realized after all Projects have been implemented. MMM Design Group has developed Projects that meet the funding requirements for the D.O.D.'s Energy Conservation Investment Program. Furthermore, the recommended Projects provide compliance with the Army Facilities Energy Plan. This summary presents data relative to the following chronological period:

- A. 1975 Energy Consumption (baseline).
- B. 1985 Energy Use (projection).

1.2 METHODOLOGY

The Analysis methodology was based in part on an examination and study of a "sampling" of structures representative of all of the structures at Fort Pickett. These "sample" or "study" buildings were used to model "building use groups" which had similar architectural, mechanical, and electrical system characteristics, as well as similar functional uses. These characteristics are summarized in Figures 1, 2, and 3.

2. EXISTING ENERGY CONSUMPTION

Once these building group system characteristics were determined, they were input into the Corps of Engineers Building Loads Analysis and Systems Thermodynamics (BLAST) Program. Then, the BLAST Program parameters were manipulated in order to simulate 1975 conditions. See Building Group Energy Usage (Figure 4) for a description of energy sources, and energy use totals by building group. Finally, a total MBTU consumption record was prepared to model actual consumption between 1975 and 1980, adjusted for historic degree days, (Figures 5). These figures reflect a total consumption of 168,999 MBTU for the 1975 baseline, including energy use for on-base buildings, Reserve Centers and all other energy consuming systems (site utilities, site lighting, etc.).

Figures 6A through 6C illustrate the relative percentages of fuel types used during the 1980 fiscal year. Noteworthy is the fact that electricity and fuel oil make up the largest portions of the consumed energy mediums, comprising 47% and 44% respectively. The remaining fuel types include LP and natural gas at 8% and kerosene at 1%.

Figures 7A through 7C indicate the annual source energy consumed by each of the significant building groups used in the energy model, and compare this consumption with the building group area. Housing is the largest user, consuming 27% of total energy, administrative the second largest consumer on-base at 20%, and shops consume 15%. Recreation and dining facilities use 10% and 7% respectively. Utilities use approximately 4%. Off-base reserve centers are the second largest overall user at 20%.

3. ENERGY CONSERVATION MEASURES DEVELOPED

3.1 Introduction

The tool used for initial analysis of possible new energy conservation measures or options at Fort Pickett was a Preliminary Matrix (Figure 8). This matrix ranked each option by building use group, and established priorities for detailed study and project development of selected options.

The separately bound "Appendix" volume of this Energy Engineering Analysis provides documentation of the back-up material developed during the course of the work. The results of the programmed energy conservation Projects are included in the separately bound volume entitled "Project Documentation." A summary of all Projects, categorized by EEA study Increment, can be found in the EEA Project Summary (Figure 9). These projects are listed in order of their E over C Ratio.

3.2 RECOMMENDED ENERGY CONSERVATION PROJECTS: INCREMENTS (A) AND (B)

A total of nine (9) projects, Increments (A) and (B), qualified under ECIP criteria as programmable energy conservation projects for on-base facilities. Included are the installation of ceiling fans for atmospheric destratification as well as noncombustable insulation for domestic water heaters and building envelopes. Also qualifying for these Increments are the replacement of inefficient oil burners, boilers and light fixtures, and the installation of night setback thermostats and a basewide Energy Management Control System.

In addition several projects qualified for Increment (A) for off-post reserve centers. Included are the installation of thermostats for night setback, minimum occupancy heating and cooling units, weatherstripping, caulking and ceiling insulation.

3.3 RECOMMENDED ENERGY CONSERVATION PROJECTS: INCREMENT (G)

A total of five (5) Projects did not meet the necessary ECIP criteria, and therefore do not appear in the Project Documentation volume of this report. These projects were subsequently classified under Increment (G). Included under this increment are the installation of storm windows, weatherstripping and caulking, timer switches for toilet room lighting, domestic water heater controls, and wall insulation for CMU walls.

3.4 RECOMMENDED ENERGY CONSERVATION PROJECTS: INCREMENT (C)

Several options were analyzed for potential renewable energy projects (Increment C). Included in this part of the study is a solar domestic water heating system, an active solar application. Trombe wall adaptations are presented as a passive solar application. Additionally, biomass fuel potential at the Fort is evaluated. None of the options analyzed qualified for ECIP funding.

3.5 RECOMMENDED ENERGY CONSERVATION PROJECTS: INCREMENT (F)

Recommendations for modifications to system operation at Fort Pickett, which are within the funding authority and/or management control of the Facilities Engineer, fall into four broad categories.

- A. Replacement of "as-needed" system components with "state-of-the-art", high-efficiency components: Such components as electrical lamps, water system pump motors, and high-bay roll-up doors, are examples of opportunities to save energy by means of Facility Engineer selection and purchase procedures.
- B. Elimination of unnecessary energy consuming items: This proposal requires coordination with current and programmed building use. It involves the elimination of domestic hot water in Administration buildings, the reduction of window glazing where not required for natural light, ventilation or egress, and the reduction of lighting levels to minimum standards.
- C. Controls of energy systems: This suggestion includes miscellaneous installations of photocell and time clock controls for lighting, selective switching of lighting and domestic hot water circulating pump controls.
- D. Future Metering Plan: Provided for the future monitoring of electricity consumption, this plan determines the high energy use buildings on base and suggests locations for future electrical meters.

The above recommendations are discussed in more detail within the body of the Report Narrative.

4. ENERGY AND COST SAVINGS

The annual energy savings by proposed Project are given in Figures 9, along with the payback period, in years. This payback is based on the implementation of all Projects by fiscal year 1985, and uses fuel types related to each respective project. Fuel cost escalation is given from 1980 to 1985 in Figure 10, entitled "Energy Cost Projection."

For projected energy consumption and total energy savings to be realized, savings from inter-related or interdependent projects must be coordinated. Thus, the total energy savings, as shown in the Energy Projection Summary (Figure 11), is based on the assumption that all projects will be implemented by a given fiscal year (1985).

5. ENERGY PLAN

A Fort Pickett Basewide Energy Savings Plan, the ultimate result of this Energy Engineering Analysis, includes energy use input from the following:

- A. Past Energy Conservation Projects.
- B. Energy Conservation Projects Under Contract.
- C. Operational and Maintenance Projects.
- D. Demolition and Shutdown.
- E. New Construction Projects.
- F. Recommended Energy Conservation Projects.

A summary of the above energy use factors is given in Figure 11, the Energy Projection Summary, with the exception of Increment C and Increment G energy savings, as well as savings from several Increment F projects which could not be projected. (See Figure 9).

As a result of total implementation of the Fort Pickett Basewide Energy Savings Plan, energy usage per square foot of building area will be reduced by over 20%. This reduction of energy usage per square foot shall equate approximately to the following:

- A. FY 1975 BTU/square foot = 72,000.
- B. FY 1985 BTU/square foot = 57,000.

See Section 3 of the Appendix for Back-up calculations of these figures.

Past and ongoing energy conservation projects, along with those projects recommended by this Energy Engineering Analysis, account for a 31% reduction in FY 1975 energy consumption. However, the sum of new construction and decreased winterization results in a 18% increase in energy consumption. This increase severely reduces the impact of the savings achieved by energy conservation projects. The final result of the savings plan, as seen in Figure 11, is an overall 13.0% decrease in annual energy consumption by FY 1985.

FORT PICKETT BUILDING USE GROUPS SUMMARY

BUILDING USE GROUP	SUB-GROUP NO.	STUDY BUILDING NO.	HALL CODE	ROOF CODE	EN. SYS. CODE	TOTAL SUB-GROUP SQUARE FEET	TOTAL USE GROUP SQUARE FEET
ADMINISTRATION	A-1	471/472/473	WD	PS	AB	274,062	284,182
	A-2	NONE	VARIES	VARIES	B	10,120	
QUARTERS	B-1	467/2442	WD	PS	AB	1,076,348	1,095,776
	B-2	NONE	VARIES	VARIES	B	19,430	
SHOPS	C-1	318/564	WD	PS	AB	280,556	293,174
	C-2	NONE	VARIES	VARIES	B	12,618	
DINING	D-1	467/2101/2440	WD	PS	AB	217,952	217,952
WAREHOUSE	E-1	NONE	VARIES	VARIES	B	465,277	465,277
RECREATION	F-1	1613	WD	PS	AB	166,506	231,760
	F-2	NONE	VARIES	VARIES	B	65,254	
NONENERGIZED	G-1	NONE	VARIES	VARIES	0	42,174	42,174
TOTAL BUILDING AREA - ON BASE (FY1980)							2,630,295
RESERVE CENTERS	R-1	MICHELLI/HALL/MONT.	MAS	BU	AB	93,632	251,379
	R-2	DUBLIN	MAS	BU	AB	77,091	
	R-3	CHARLOTTESVILLE	MAS	BU	AB	34,925	
	R-4	COVINGTON	MAS	BU	AB	45,731	
TOTAL BUILDING ARE - OFF BASE RESERVE CENTERS (FY 1980)							251,379
WALL CONSTRUCTION CODE: WD - WOOD FRAME OR WOOD FRAME WITH BRICK VENEER. ENERGIZED SYSTEMS CODE: AB - HEATING AND NON HEATING SYS. MAS - MASONRY BLOCK OR BRICK. B - NON-HEATING SYSTEMS. ROOF CONSTRUCTION CODE: PS - PITCHED SHINGLE OVER WOOD DECK. 0 - NO ENERGIZED SYSTEMS. BU - BUILT UP ROOF OVER WOOD DECK OR METAL DECK.							

FIGURE 1

FORT PICKETT CONSTRUCTION CHARACTERISTICS OF TYPICAL BUILDINGS

SUB GROUP NUMBER	BUILD. NUMBER	BUILDING USE	NO. OF FLOORS	BUILD. AREA (FT. ²)	ROOF TYPE AREA (FT. ²)	U VALUE	WALL TYPE AREA (FT. ²)	U VALUE	DOOR TYPE AREA (FT. ²)	U VALUE	FLOOR TYPE PERIM. (FT.)	U VALUE	WINDOW TYPE AREA (FT. ²)	U VALUE
A-2	471	MILITARY POLICE HDQTRS.	1	6606	ASPH. SHGL. (7590)	0.04	METAL SDG. (3392)	0.16	WOOD (200)	0.60	CRAWL (524)	0.27	STORM (468)	0.99
A-1	472	POST HDQTRS.	1	6606	ASPH. SHGL. (7590)	0.04	METAL SDG. (3392)	0.16	WOOD (140)	0.60	CRAWL (524)	0.27	STORM (564)	0.99
A-1	473	POST HDQTRS.	1	6606	ASPH. SHGL. (7590)	0.04	METAL SDG. (3392)	0.16	WOOD (140)	0.60	CRAWL (524)	0.27	STORM (564)	0.99
B-1/ B-2	2442	BARRACKS	2	5310	ASPH. SHGL. (2400)	0.36	VINYL SDG. (2963)	0.24	WOOD (76)	0.60	EXPOSED (220)	0.62	SGL.PN. WD.FRM. (642)	0.99
B-1	467	BARRACKS	1	5681	ASPH. SHGL. (5681)	0.05	BRICK WD.SDG. (3372)	0.17	METAL (168)	0.60	SLAB (7889)	-	THERMAL (448)	0.99
C-1	318	MOTOR REPAIR SHOP	1	22770	BUILT UP (23431)	0.05	METAL SDG. (19699)	0.21	WOOD (432)	0.60	SLAB (632)	-	STORM (2541)	0.99
C-1	564	MOTOR REPAIR SHOP	1	18270	BUILT UP (18800)	0.05	METAL SDG. (15806)	0.21	WOOD (323)	NEG.	SLAB (632)	-	STORM (2160)	0.99
D-1	467	MESS HALL	1	6275	ASPH.S BLT-UP (6440)	0.03	BRICK WD.SDG. (3827)	0.10	METAL (350)	0.60	SLAB (382)	-	THERMAL (236)	0.99
D-1	2101	NCO CLUB	2	20740	ASPH. SHGL. (2.342)	0.07	METAL SDG. (6740)	0.16	METAL (336)	0.60	CRAWL (1000)	0.28	STORM (924)	0.99
D-1	2440	MESS	1	2950	ASPH. SHGL. (2408)	0.25	VINYL SDG. (1767)	0.27	WOOD (108)	0.60	EXPOSED (238)	0.53	SGL.PN. WD.FRM. (300)	0.99
F-1	1613	SPORTS ARENA	1	24368	DOMED ENTRY (20272) (4896)	0.06	METAL SDG. (5002)	0.16	WOOD (485)	0.65	SLAB (838)	-	SGL. GLZ. (2033)	1.10

■ - BLDG. 467 CONSISTS OF A 3-BLDG. COMPLEX, 2-IDENTICAL BARRACKS AND 1-MESS HALL

■ - WEIGHTED AVERAGE

FIGURE 2

FORT PICKETT CONSTRUCTION CHARACTERISTICS OF TYPICAL BUILDINGS

SUB GROUP NUMBER	BUILD. NUMBER	BUILDING USE	NO. OF FLOORS	BUILD. AREA (FT.)	ROOF TYPE AREA (FT.)	U VALUE	WALL TYPE AREA (FT.)	U VALUE	DOOR TYPE AREA (FT.)	U VALUE	FLOOR TYPE PERIM. (FT.)	U VALUE	WINDOW TYPE AREA (FT.)	U VALUE
F-2	2442	BARRACKS	2	5310	ASPH. SHGL. (2400)	0.36	VINYL SDG. (2963)	0.24	WOOD (76)	0.60	EXPOSED (220)	0.62	SGL.PN. WD.FRM. (642)	0.99
R-1	SALEM	HALL RESERVE CENTER	2	25628	BUILT UP (15132)	0.09	BRICK (14030)	0.32	METAL (424)	0.60	SLAB (750)	-	SGL.GLZ 50% ST. (2272)	1.00
R-1	SHERWD.	MICHELLI RESERVE CENTER	2	30727	BUILT UP (20724)	0.09	BLOCK (15822)	0.49	METAL (382)	0.60	SLAB (1586)	-	SGL. GLZ. (2263)	1.10
R-1	BELT	MONTEITH RESERVE CENTER	2	23324	BUILT UP (13840)	0.09	BRICK (11422)	0.32	METAL (424)	0.60	SLAB (750)	-	SGL. GLZ. (1877)	1.10
R-2	DUBLIN	DUBLIN RESERVE CENTER	1	21014	BUILT UP (21400)	0.09	BRICK (10420)	0.32	METAL (375)	0.60	SLAB (710)	-	SGL. GLZ. (1672)	1.10
R-3	CHARLOTT -ESVILLE	CHARLOTT -ESVILLE RES. CTR.	1	19125	BUILT UP (19375)	0.09	BRICK (984)	0.32	METAL (420)	0.60	SLAB (680)	-	SGL. GLZ. (1440)	1.10
R-4	COVING -TON	COVINGTON RESERVE CENTER	1	5982	BUILT UP (6210)	0.09	BRICK (2832)	0.32	METAL (230)	0.60	SLAB (285)	-	SGL. GLZ. (630)	1.10

■ - BLDG. 467 CONSISTS OF A 3-BLDG. COMPLEX, 2-IDENTICAL BARRACKS AND 1-MESS HALL

■ - WEIGHTED AVERAGE

FIGURE 2 (CONT.)

FORT PICKETT TYPICAL BUILDING SYSTEMS SUMMARY

SUB GROUP NUMBER	BUILDING NUMBER	BUILDING USE	COOLING		HEATING		DOMESTIC HOT WATER		NORMAL PEAK OCCUPANCY	OCCUPANCY SCHEDULE
			SYSTEM TYPE	CAPACITY (TONS)	SYSTEM TYPE	FUEL	SYSTEM TYPE	FUEL		
A-2	471	MILITARY POLICE HDQTRS.	NONE	-	CENTRAL STEAM	FUEL OIL	WATER HEATER	ELEC.	25	24 HRS/DAY 365 DAYS/YR.
A-1	472	POST HDQTRS.	NONE	-	CENTRAL STEAM	FUEL OIL	WATER HEATER	ELEC.	20	8 HRS/DAY 5 DAYS/WK
A-1	473	POST HDQTRS.	NONE	-	CENTRAL STEAM	FUEL OIL	WATER HEATER	ELEC.	20	60 HRS/WK 6 MO/YR VARIES-6 MO/YR
B-1/ B-2	2442	BARRACKS	NONE	-	FORCED AIR	OIL	85 GAL.	OIL	25	24 HR, 7 DAY/ WINTERIZED
B-1	467 ^{***}	BARRACKS	CENTRAL CHILLER	29.0	CENTRAL HOT WATER	FUEL OIL	WATER HEATER	FUEL OIL	32	12 HRS/DAY 7 DAYS/WK
C-1	318	MOTOR REPAIR SHOP	NONE	-	STEAM	FUEL OIL	WATER HEATER	ELEC.	16	10 HRS/DAY-5 DAYS/WK 24 HRS/DAY 14 DAYS/YR
C-1	564	MOTOR REPAIR SHOP	NONE	-	STEAM	FUEL OIL	WATER HEATER	ELEC.	18	10 HRS/DAY 5 DAYS/WK
D-1	467 ^{***}	MESS HALL	CENTRAL CHILLER	29.0	CENTRAL HOT WATER	FUEL OIL	WATER HEATER	FUEL OIL	50 ^{***}	12 HRS/DAY 7 DAYS/WK
D-1	2101	NCO CLUB	PACKAGE UNITS	(1)-10.0 (3)-7.5	STEAM	FUEL OIL	WATER HEATER	ELEC.	60	52 HRS/WK 52 WKS/YR
D-1	2440	MESS	NONE	-	FORCED AIR	OIL	500 GAL.	OIL	150	0530-1630 1 WK/MO
F-1	1613	SPORTS ARENA	NONE	-	STEAM	FUEL OIL/ LP IGN.	WATER HEATER	FUEL OIL	40	70 HRS/WK 52 WKS/YR

^{***} - BLDG. 467 CONSISTS OF A 3-BLDG. COMPLEX, 2-IDENTICAL BARRACKS AND 1-MESS HALL

^{***} - WEIGHTED AVERAGE

FIGURE 3

FORT PICKETT TYPICAL BUILDING SYSTEMS SUMMARY

[illegible]

... - BLDG 467 CONSISTS OF A 3-BLDG. COMPLEX, 2-IDENTICAL BARRACKS AND 1-MESS HALL

WEIGHTED AVERAGE

FIGURE 5 (CONT.)

BUILDING GROUP ENERGY USAGE

FORT PICKETT - 1975 - BASE YEAR

SUB-GROUP	STUDY BUILDING	Y/W	TOTAL GROUP SQ.-FT.	STUDY BUILDING GROUP AVERAGE BTU/FT ² -YR.			TOTAL BUILDING GROUP AVERAGE MBTU/YR.		
				ELECTRIC	FUEL	TOTAL	ELECTRIC	FUEL	TOTAL
A-1	471	Y	127,110	70,608	119,548	190,157	8,975	15,196	24,171
		W	146,542	40,473	11,686	52,159	5,931	1,712	7,643
A-2	471	W	8,552	40,473	11,686	52,159	346	100	446
B-1	2442 467.B	Y	65,707	62,000	116,925	178,925	4,074	7,683	11,757
	2442 (ONLY)	W	1,009,312	19,790	19,396	39,186	19,974	19,577	39,551
B-2	2442	W	19,430	19,790	19,396	39,186	385	377	762
C-1	318 564	Y	168,438	48,485	102,095	150,580	8,167	17,197	25,364
		W	114,535	18,370	6,012	24,382	2,104	689	2,793
D-1	2440	Y	20,740	35,485	139,742	175,227	736	2,898	3,634
		W	190,937	14,600	40,625	55,225	2,788	7,757	10,545
F-1	1613	Y	24,368	193,969	147,065	341,034	4,727	3,584	8,311
		W	142,138	49,093	8,462	57,555	6,978	1,203	8,181
F-2	2442	W	65,254	19,790	19,396	39,186	1,291	1,266	2,557
Y-DENOTES YEAR ROUND BUILDING USE W-DENOTES WINTERIZED BUILDING				SITE UTILITIES AND LIGHTING -			7,751	-	7,751
				BASEWIDE CALCULATED -			74,227	79,238	153,466
				BASEWIDE HISTORICAL -			54,921	79,516	134,437

BUILDING GROUP ENERGY USAGE

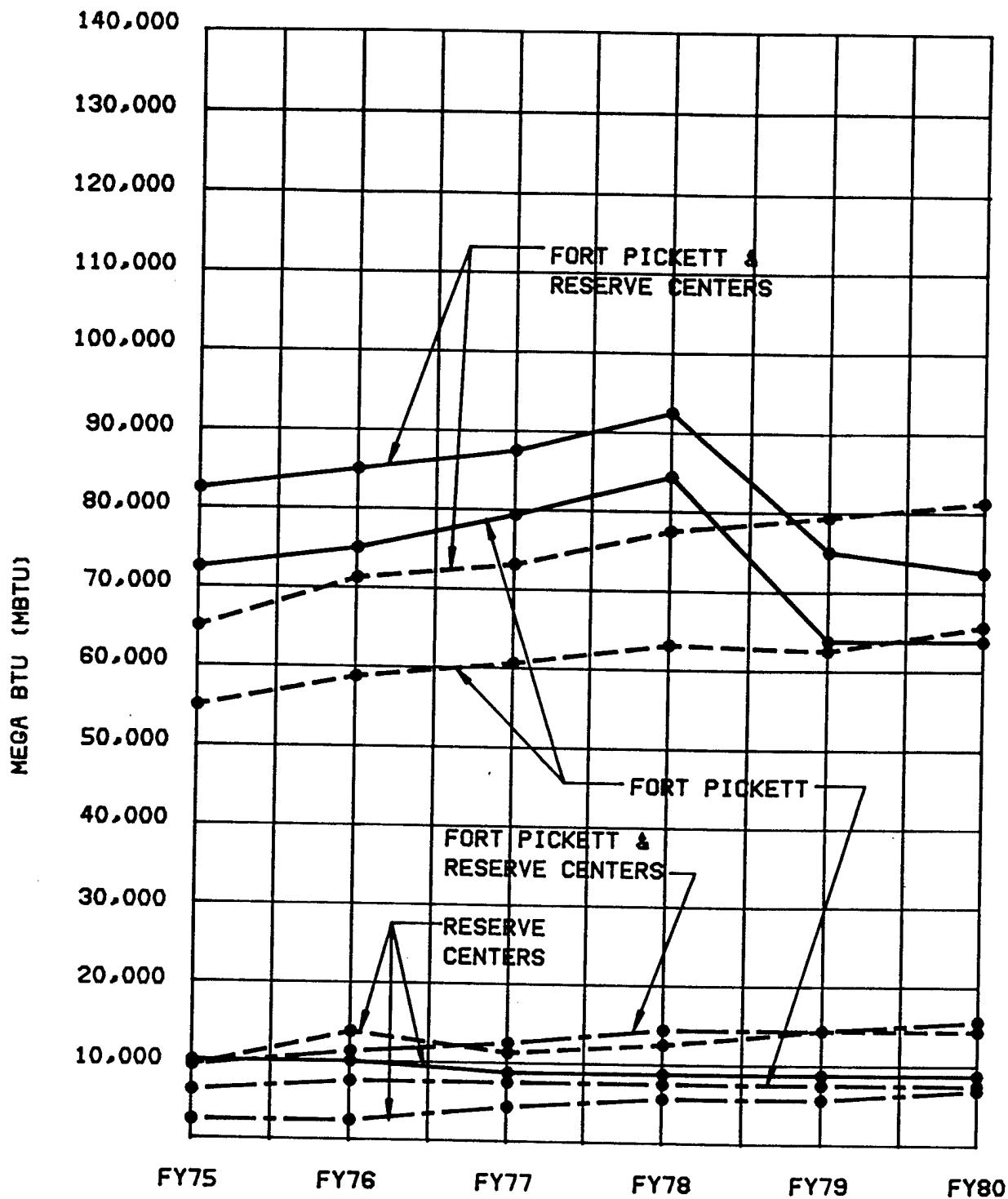
RESERVE CENTERS - 1975 - BASE YEAR

SUB-GROUP	STUDY BUILDING	Y/W	TOTAL GROUP SQ.-FT.	STUDY BUILDING GROUP AVERAGE BTU/FT ² -YR.			TOTAL BUILDING GROUP AVERAGE MBTU/YR.		
				ELECTRIC	FUEL	TOTAL	ELECTRIC	FUEL	TOTAL
R-1	HALL MONTEITH MICHELLI	Y	93,632	62,474	116,171	178,645	5,850	10,877	16,727
		-	-	-	-	-	-	-	-
R-2	DUBLIN	Y	77,091	99,522	75,591	175,113	7,672	5,827	13,499
R-3	CHARLOTT-ESVILLE	Y	34,925	56,946	56,784	113,730	1,989	1,983	3,972
R-4	COVINGTON	Y	45,731	44,018	75,764	119,782	2,013	3,465	5,478
RESERVE CENTER CALCULATED ENERGY CONSUMPTION -							17,524	22,152	39,676
RESERVE CENTER HISTORICAL ENERGY CONSUMPTION -							16,743	17,769	34,512
GRAND TOTAL CALCULATED ENERGY CONSUMPTION -							91,751	101,391	193,142
GRAND TOTAL HISTORICAL ENERGY CONSUMPTION -							71,664	97,285	168,949

NOTE: CALCULATED CONSUMPTION DATA IS FROM BLAST ANALYSIS.
HISTORICAL CONSUMPTION DATA IS FROM FORT PICKETT ENERGY CONSUMPTION RECORDS.

Y-DENOTES YEAR ROUND BUILDING USE
W-DENOTES WINTERIZED BUILDING

FIGURE 4 (CONT.)



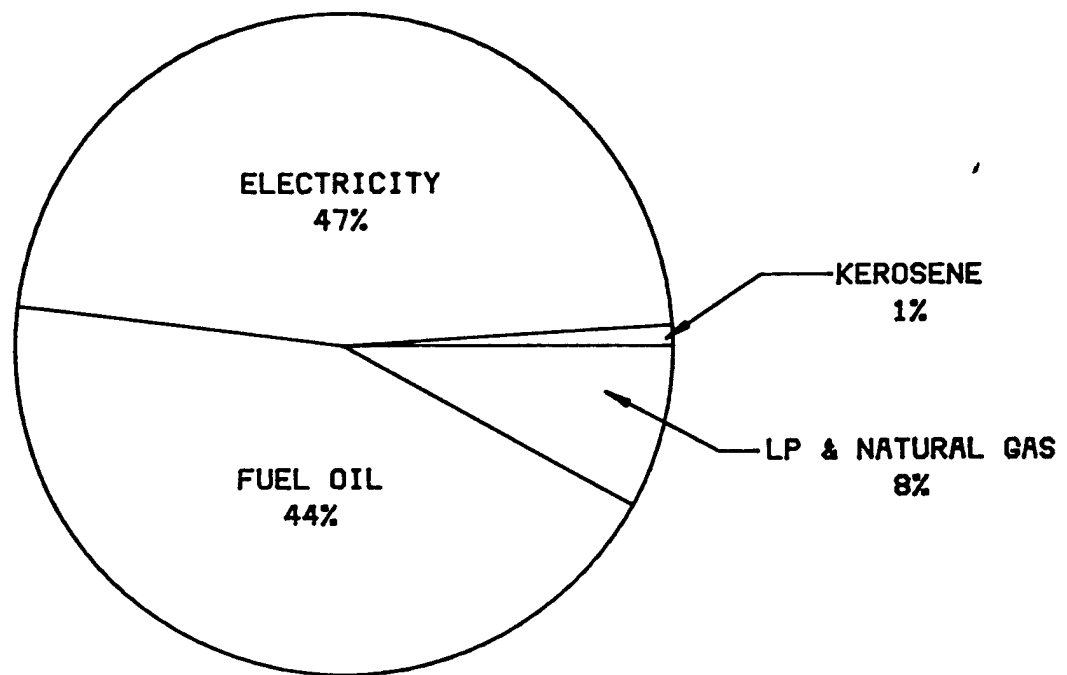
TOTAL ENERGY CONSUMPTION
FOR
FY75 THRU FY80
FORT PICKETT & RESERVE CENTERS
FIGURE 5

KEY

———— FUEL OIL & KEROSENE

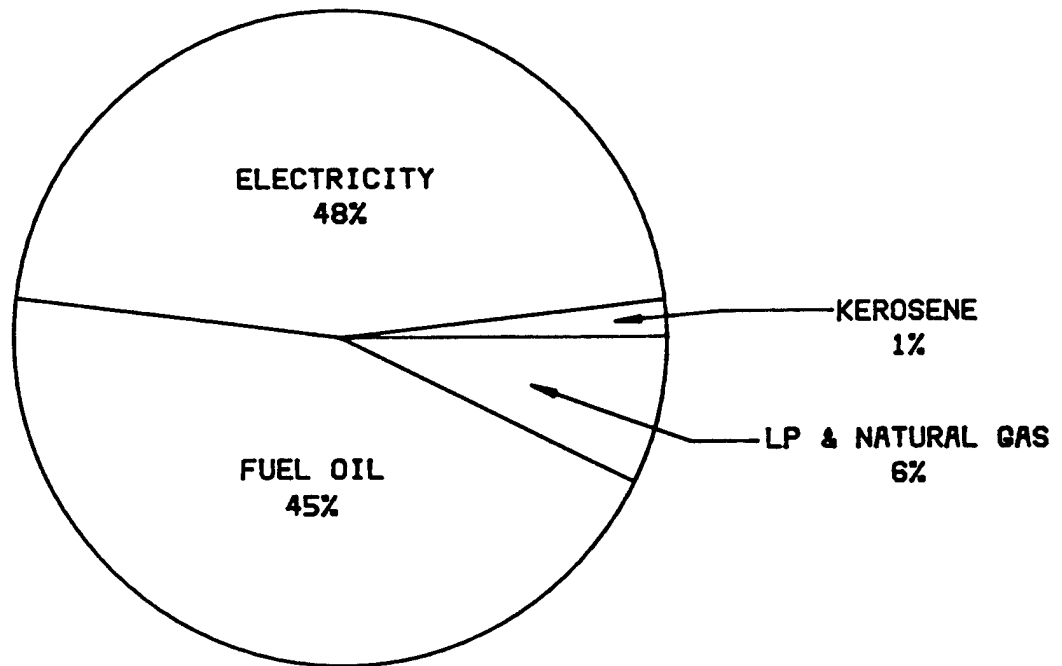
----- ELECTRICITY

- - - - LP & NATURAL GAS



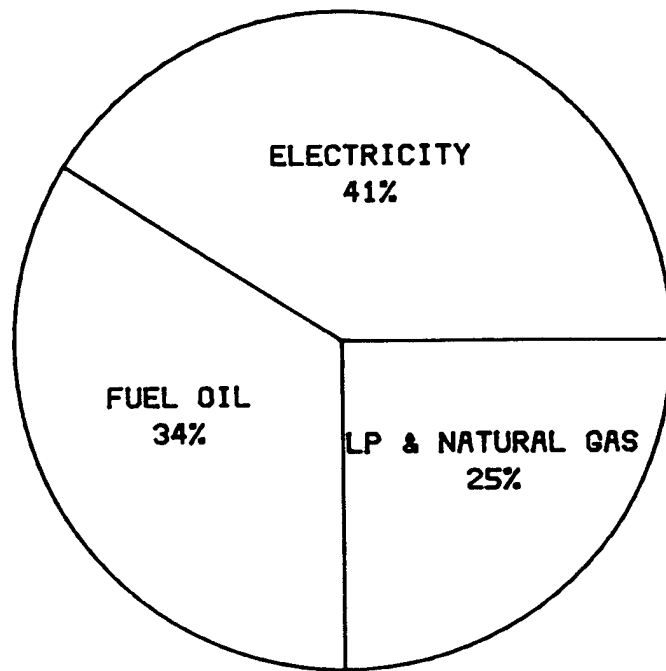
TOTAL ENERGY USE
FY 1980
FORT PICKETT & RESERVE CENTERS
155,348 MBTU PER YEAR

FIGURE 6A



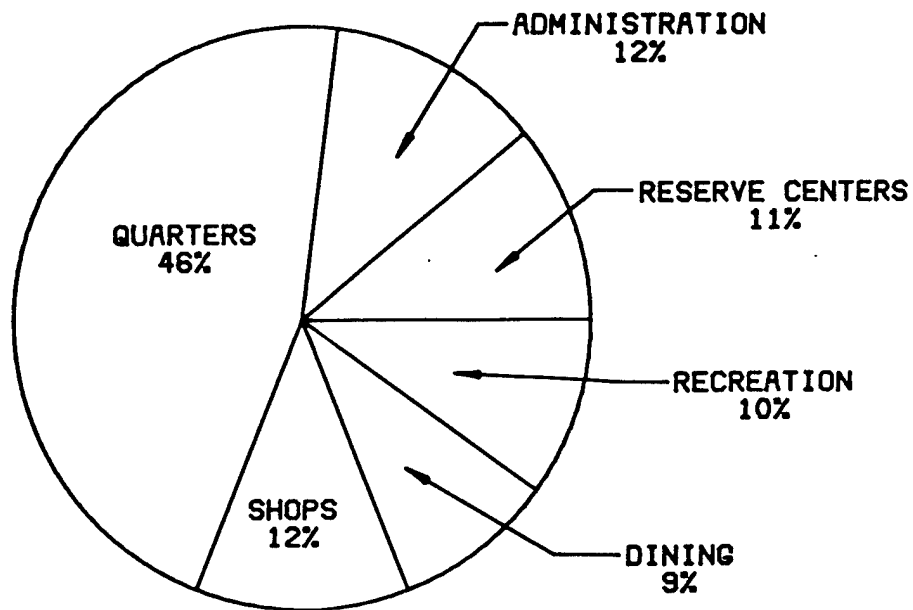
TOTAL ENERGY USE
FY 1980
FORT PICKETT
139,366 MBTU PER YEAR

FIGURE 6B



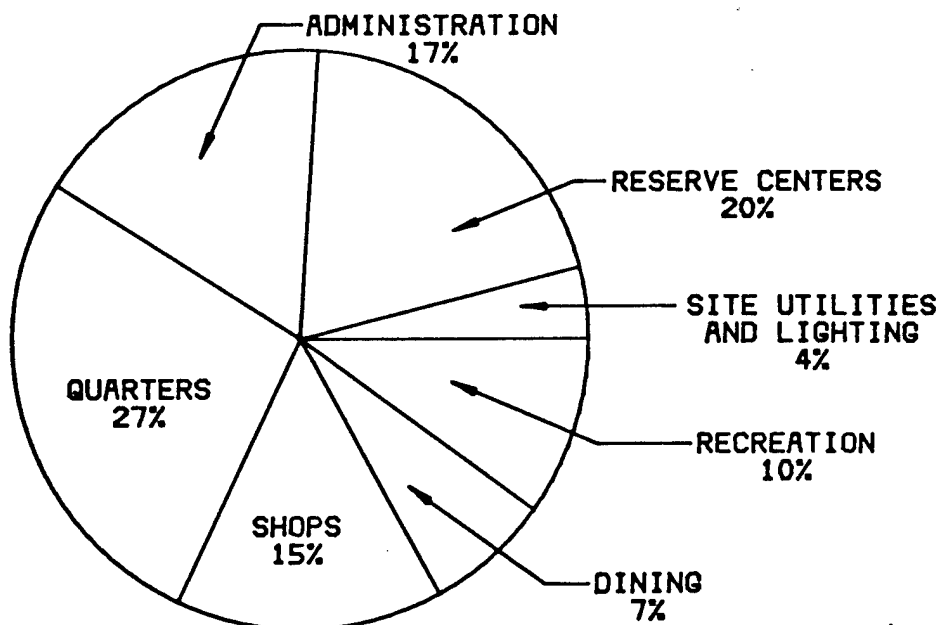
TOTAL ENERGY USE
FY 1980
RESERVE CENTERS
15,982 MBTU PER YEAR

FIGURE 6C



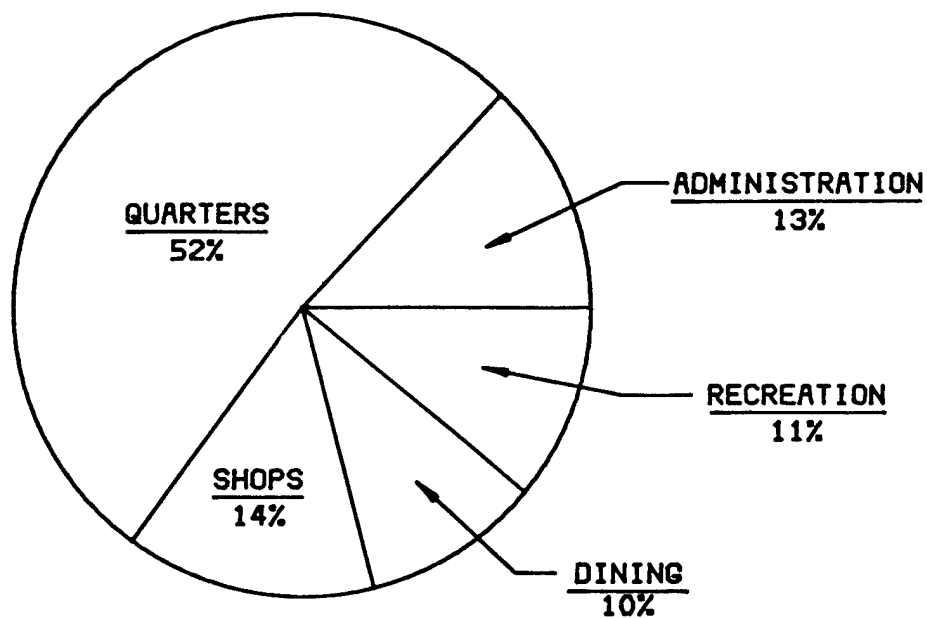
FT. PICKETT & RESERVE CENTERS BLDG. USE GROUP AREA

TOTAL BUILDING AREA = 2,354,442 SQ. FT.



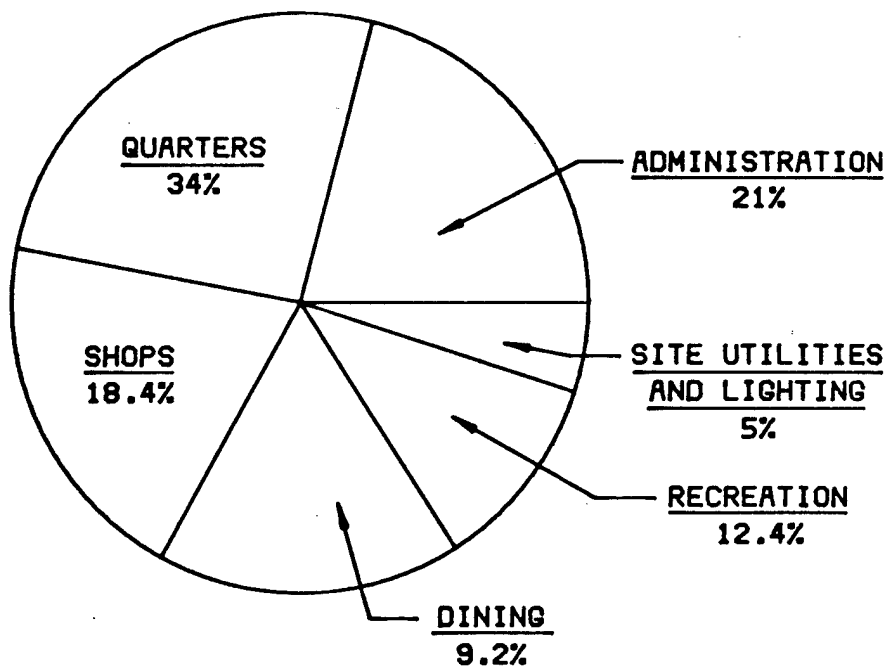
FT. PICKETT & RESERVE CENTERS BLDG. GROUP ENERGY USE

TOTAL ENERGY USE = 168,949 MILLION BTU



FORT PICKETT BLDG. USE GROUP AREA

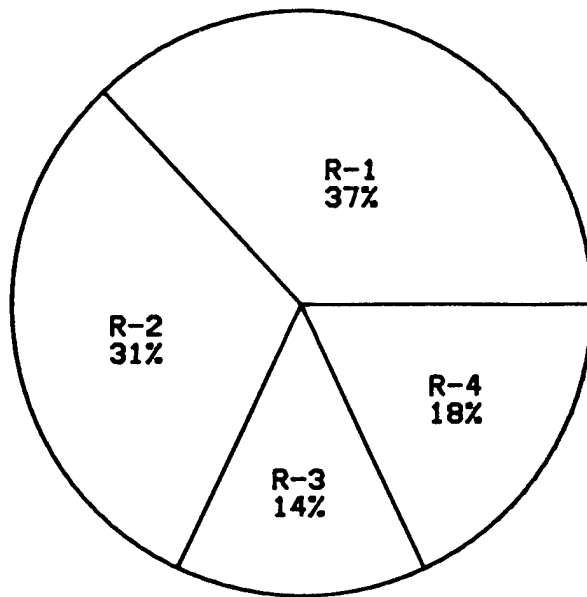
TOTAL BUILDING AREA = 2,103,063 SQ. FT.



FORT PICKETT BLDG. GROUP ENERGY USE

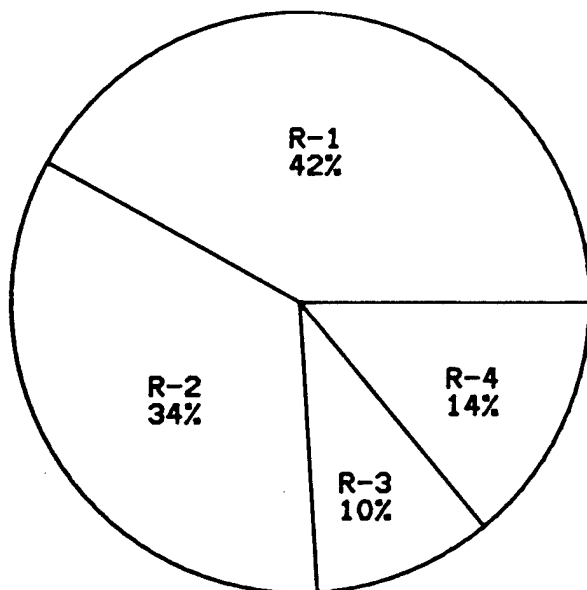
TOTAL ENERGY USE = 134,437 MILLION BTU

FIGURE 7B



RESERVE CENTERS BLDG. USE GROUP AREA

TOTAL BUILDING AREA = 251,379 SQ. FT.



RESERVE CENTERS BLDG. GROUP ENERGY USE

TOTAL ENERGY USE = 34,512 MILLION BTU

FIGURE 7C

FORT PICKETT

ENERGY ENGINEERING ANALYSIS PROGRAM
CONTRACT NO. DACA65-81-C-0021

LEGEND:

- X = GOOD OPTION
- Y = FEASIBLE OPTION
(TO RECEIVE PRELIMINARY STUDY)
- Z = POOR OPTION
(SEE COMMENTS)
- O = NOT APPLICABLE
- = USE GROUP BLDGS. (AGGREGATE AREA)
WITHOUT ENERGIZED HEATING SYSTEMS

A. ENVELOPE

FORT PICKETT																							
ENERGY ENGINEERING ANALYSIS PROGRAM CONTRACT NO. DACA65-81-C-0021																							
LEGEND:																							
X = GOOD OPTION																							
Y = FEASIBLE OPTION (TO RECEIVE PRELIMINARY STUDY)																							
Z = POOR OPTION (SEE COMMENTS)																							
O = NOT APPLICABLE																							
■ = USE GROUP BLDGS. (AGGREGATE AREA) WITHOUT ENERGIZED HEATING SYSTEMS																							
BUILDING USE GROUP	SUB-GROUP	STUDY BLDG.	EXTERIOR VESTIBULES	INTERIOR VESTIBULES	STORM WINDOWS	WEATHERSTRIPPING & CAULKING	CEILING INSULATION	HALL INSULATION	FLOOR INSULATION	REDUCTION OF WINDOW GLAZING	TROMBE HALL ADAPTATION	OVERHEAD DOOR REPLACEMENT	DROPPED CEILING					DOMESTIC HOT WATER	WATER HEATER TIME CLOCK	HW CIRC. PUMP CONTROLS	INSULATE DHW PIPING	INSULATE DHW HEATER	SHOWER / LAV. FLOW RESTRICTORS
ADMINISTRATION	A-1	471	Z	Y	O	X	Y	Y	Y	O	O	O	O						Z	O	X	O	Z
		472	Z	Y	O	X	Y	Y	Y	O	O	O	O						X	O	X	O	Z
		473	Z	Y	O	X	Y	Y	Y	O	O	O	O						X	O	X	O	Z
		2010	Z	O	X	X	Z	X	O	O	O	O	O						X	Y	X	O	Z
	A-3	■	O	O	O	O	O	O	O	O	O	O							O	O	O	O	O
QUARTERS	B-1	467	Z	O	Z	X	Z	Z	O	O	O	O							Z	O	O	O	X
		2442	Z	O	X	X	X	X	X	O	O	O	O						Z	O	Z	Z	O
	B-2	■	O	O	O	O	O	O	O	O	O	O							O	O	O	O	O
SHOPS	C-1	318	Z	O	O	X	Y	Y	O	Y	O	X	Y						X	O	O	X	Z
		564	Z	O	O	X	Y	Y	O	O	O	X	Y						X	O	O	X	Z
	C-2	■	O	O	O	O	O	O	O	O	O	O							O	O	O	O	O
DINING	D-1	467	Y	O	Z	O	Z	Z	O	O	O	O							Z	O	O	O	Z
		2101	Y	O	O	X	Y	Y	Y	O	O	O							X	O	X	X	Z
		2440	Z	O	X	X	X	X	X	O	O	O	O						Z	O	Z	Y	O
WAREHOUSE	E-1	■	O	O	O	O	O	O	O	O	O	O							O	O	O	O	O
RECREATION	F-1	1613	Y	O	X	X	Z	Y	O	Y	O	O							Z	O	O	X	X
	F-2	■	O	O	O	O	O	O	O	O	O	O							O	O	O	O	O
RESERVE CENTERS	R-1	MICHELLY	O	Z	X	X	Y	X	O	Y	Y	X	O						O	O	O	O	O
		MONTETH	O	Z	X	X	Y	X	O	Y	Y	X	O						O	O	O	O	O
		HALL	O	Z	X	X	Y	X	O	Y	Y	X	O						X	X	X	X	O
	R-2	DUBLIN	O	Z	Y	Y	Z	Z	O	Z	Z	Z	O						Z	O	Z	Y	O
	R-3	CHARLOTTSVILLE	O	Z	Y	Y	Z	Z	O	Z	Z	Z	O						Z	O	Z	Y	O
	R-4	COVINGTON	O	Z	Y	X	Z	Z	O	Z	Z	Z	O						Z	O	Z	Y	O
SITE UTILITIES & LTG.			O	O	O	O	O	O	O	O	O	O						O	Y	O	O	O	

PRELIMINARY MATRIX - ENERGY C

[illegible][illegible]

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EEA PROJECT SUMMARY

INC.	PROJECT	SIR	E/C RATIO	B/C RATIO	INSTALL. COST (#)	ANNUAL SAVINGS (MBTU)	PAYBACK (YRS.)
A	WATER HEATER INSULATION	42.9	160.8	54.9	31,477	5,060	0.4
A	BURNER REPLACEMENT	29.7	107.0	37.9	2,834	303	0.6
A	CEILING FANS	11.8	38.5	15.0	48,549	1,870	1.6
A	NIGHT SETBACK (FORT PICKETT)	3.6	25.7	4.3	220,841	5,679	3.4
A	REPLACEMENT OF INEFFICIENT LIGHT FIXTURES	1.6	14.3	1.8	138,325	1,989	9.2
B	EMCS	1.7	13.2	2.2	677,334	8,916	7.5
A	WALL INSULATION	2.9	12.4	3.7	126,089	1,557	6.2
A	CEILING INSULATION (FORT PICKETT)	2.7	9.7	3.4	356,887	3,479	7.0
A	BOILER REPLACEMENT	1.9	6.8	24.1	230,757	1,571	1.0
A	NIGHT SETBACK (RESERVE CENTERS)	23.6	162.1	26.9	7,489	1,241	0.6
A	MINIMUM OCCUPANCY HTG/CLG UNITS (RESERVE CENTERS)	1.8	12.4	2.1	12,953	160	7.0
A	WEATHERSTRIPPING & CAULKING (RES. CTRS.)	4.5	18.8	6.2	14,556	273	4.3
A	CEILING INSULATION (RESERVE CENTERS)	23.2	90.4	30.8	28,695	2,594	0.8
	TOTAL:	-	-	-	1,897,796	34,692	-

FIGURE 9

EEA PROJECT SUMMARY

[illegible]

FIGURE 10

EEA PROJECT SUMMARY

[illegible]■ PER 100 FT² OF COLLECTOR AREA

FIGURE 11

EEA PROJECT SUMMARY

INCREMENT	PROJECT	E/C RATIO	B/C RATIO	INSTALL. COST (#)	ANNUAL SAVINGS (MBTU)	PAYBACK (YRS.)
F	WATER HEATER CONTROLS (RESERVE CENTERS)	43.5	5.1	3,321	145	2.7
F	REPLACE INEFFICIENT LIGHT FIXTURES (RESERVE CENTERS)	10.3	1.4	4,082	42	9.5
F	REPLACE INEFFICIENT SITE LIGHTING (RESERVE CENTERS)	20.6	3.6	1,625	34	4.0
F	REPLACE STANDARD FLUORESCENT LAMPS (FORT PICKETT)	36.6	7.4	17,206	629	3.5
	TOTAL:			64,401	3,225	

NOTE: ANNUAL MBTU SAVINGS MARKED THUS () WERE CALCULATED ON A "PER UNIT" BASIS AND COULD NOT BE QUANTIFIED WITH TOTAL SAVINGS.

FIGURE 12

EEA PROJECT SUMMARY

INCREMENT	PROJECT	E/C RATIO	B/C RATIO	INSTALL. COST (#)	ANNUAL SAVINGS (MBTU)	PAYBACK (YRS.)
F	PHOTOCELL & TIME CLOCK LIGHTING CONTROLS	113.0	8.4	636	72	1.1
F	REPLACE STANDARD FLUORESCENT LAMPS (FORT PICKETT)	89.6	4.1	19,689	1,765	1.5
F	REDUCE LIGHTING LEVELS TO MINIMUM STANDARDS	62.0	8.0	8,638	538	2.2
F	HIGH EFFICIENCY-TYPE MOTORS	23.3	1.3	637	(14)	5.5
F	DOMESTIC HOT WATER CIRCULATING PUMP CONTROL	43.4	4.8	219	(10)	(2.2)
F	INSULATED DAMPER PANELS	30.9	9.2	76	(2)	3.7
F	ELIMINATION OF DOMESTIC HOT WATER	3267.1	564.8	15	(48)	0.1
F	REDUCTION OF WINDOW GLAZING	79.1	28.8	20	(2)	0.9
F	REPLACEMENT OF OVERHEAD DOORS	37.4	14.0	3263	(122)	1.8
F	CORRECT POWER FACTOR	-	-	6,586	-	18.0
F	FUTURE METERING PLAN	-	-	1,982	-	-

NOTE: ANNUAL MBTU SAVINGS MARKED THUS () WERE CALCULATED
ON A "PER UNIT" BASIS AND COULD NOT BE QUANTIFIED
WITH TOTAL SAVINGS.

FIGURE 12 (CONT.)

ESCALATED ACTUAL FUEL COST (\$/MBTU)						
FUEL #	FISCAL YEAR					
	1980	1981	1982	1983	1984	1985
ELECTRICITY	4.31	4.48	5.15	5.93	6.81	7.84
#2 FUEL OIL	7.02	8.54	9.83	11.30	12.99	14.94
NATURAL GAS	4.17	5.06	6.07	7.29	8.74	10.49

ENERGY COST PROJECTION

■ ESCALATED AS RECOMMENDED BY CORPS OF ENGINEERS "ENERGY CONSERVATION INVESTMENT PROGRAM GUIDANCE" APPENDIX B, TABLE 2.

FIGURE 13

ENERGY PROJECTION SUMMARY

ITEM	MBTU	PERCENT CHANGE
FY 1975 TOTAL ENERGY CONSUMPTION	168,949	-
A. PAST ENERGY CONSERVATION PROJECTS	(-) 7,623	(-) 4.5%
B. ENERGY CONSERVATION PROJECTS UNDER CONTRACT	(-) 4,898	(-) 3.9%
C. EXISTING OPERATIONAL & MAINTENANCE PROCEDURES	(+) 19,398	(+) 11.5%
D. DEMOLITION AND SHUTDOWN	(-) 276	(-) 0.1%
E. NEW CONSTRUCTION PROJECTS	(+) 10,729	(+) 6.4%
F. RECOMMENDED ENERGY PROJECTS: INCREMENTS (A), (B) & (F)	(-) 37,917	(-) 22.4%
FY 1985 ENERGY CONSUMPTION PROJECTION	148,362	(-) 13.0%

NOTES:

1. ENERGY SAVINGS RESULTING FROM SOME INCREMENT (F) PROJECTS COULD NOT BE PROJECTED, SEE FIGURE 3-7.

2. (-) INDICATES A REDUCTION IN ENERGY USE, (+) INDICATES AN INCREASE IN ENERGY USE.

3. SEE SECTION 3.4 OF THE REPORT NARRATIVE FOR FURTHER DESCRIPTION OF O&M PROCEDURES.

4. TOTAL MBTU QUANTITIES IN THIS FIGURE REFLECT THE COMBINATION FORT PICKETT & RESERVE CENTER TOTALS.

FIGURE 14